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Web Resources

Complex Numbers

www.mathwarehouse.com/algebra/complex-number/home.php



Simplifying Imaginary Numbers:

www.mathwarehouse.com/algebra/complex-number/imaginary-number-lesson.php

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Introduction to Imaginary and Complex numbers

When a Real number is squared the result is always non-negative. Imaginary numbers of the form bi are numbers that when squared result in a negative number.

A complex number is a number with a Real part, a , and an imaginary part, bi written in the form $a + bi$

$$i = \sqrt{-1}$$

$$i^2 = -1$$

I. Model Problems

In this example we will simplifying imaginary numbers.

Example 1: $\sqrt{-9}$

Write the number under the radicand as a product of -1 and a non-negative number.

Write as product of radicals.

Find the roots.

Answer: $3i$

$$\sqrt{-9} = \sqrt{9 \cdot -1}$$

$$\sqrt{9 \cdot -1} = \sqrt{9}\sqrt{-1}$$

$$\sqrt{9}\sqrt{-1} = 3i$$

In these examples we will practice simplify powers of i .

Example 2: i^4

Rewrite as product of i^2 's and i 's.

Substitute.

Simplify.

Answer: $i^4 = 1$

$$i^4 = i^2 \cdot i^2$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1$$

$$-1 \cdot -1 = 1$$

Example 3: i^7

Rewrite as product of i^2 's and i 's.

Substitute.

Simplify.

Answer: $i^7 = -i$

$$i^7 = i^2 \cdot i^2 \cdot i^2 \cdot i$$

$$i^7 = i^2 \cdot i^2 \cdot i^2 \cdot i = -1 \cdot -1 \cdot -1 \cdot i$$

$$-1 \cdot -1 \cdot -1 \cdot i = -i$$

In this example we will simplify a complex number.

Example 4: $\sqrt{81} + \sqrt{-36}$

Write the number under the radicand of the imaginary part of the complex number as a product of -1 and a non-negative number.

Write as product of radicals.

Find the roots of both parts of complex number.

Answer: $9 + 6i$

$$\sqrt{81} + \sqrt{-36} = \sqrt{81} + \sqrt{36 \cdot -1}$$

$$\sqrt{81} + \sqrt{36 \cdot -1} = \sqrt{81} + \sqrt{36}\sqrt{-1}$$

$$\sqrt{81} + \sqrt{36}\sqrt{-1} = 9 + 6i$$

II. Practice Problems

Simplify.

1. $\sqrt{-36}$

3. $\pm\sqrt{-49}$

5. $\sqrt{-100}$

7. $\sqrt{-144}$

9. $3\sqrt{-9}$

11. $16 - \sqrt{-16}$

13. $16 - \sqrt{-169}$

15. $3.5 + \sqrt{-1.21}$

17. $157 - \sqrt{-324}$

19. i^3

21. i^9

23. i^{12}

25. $24i^{20}$

2. $\sqrt{-121}$

4. $\sqrt{-81}$

6. $-\sqrt{-16}$

8. $11\sqrt{-81}$

10. $-2\sqrt{-16}$

12. $-24 \pm \sqrt{-9}$

14. $2.6 + \sqrt{-81}$

16. $-48 \pm \sqrt{-256}$

18. $44 - \sqrt{-1}$

20. i^5

22. i^8

24. $8i^{15}$

III. Challenge Problems**Simplify**

1. i^{255}

2. i^{1024}

3. For i^x where x is an even number greater than 0 develop a rule to determine if i^x simplified is 1 or -1 .

4. Find the error in the student's work.

$$14 - \sqrt{16}$$

$$14 + \sqrt{16}$$

$$14 + 4$$

$$18$$

IV. Answer Key

1. $6i$
2. $11i$
3. $\pm 7i$
4. $9i$
5. $10i$
6. $-4i$
7. $12i$
8. $99i$
9. $9i$
10. $-8i$
11. $24 \pm 3i$
12. $16 - 3i$
13. $2.9 + 9i$
14. $3.5 \pm 1.1i$
15. $-48 \pm 16i$
16. $157 - 18i$
17. $44 - i$
18. $-i$
19. i
20. i
21. 1
22. 1
23. $-8i$
24. 24

Challenge Problems

1. $-i$
2. 1
3. If $\frac{x}{2}$ is an even number, then $i^x = 1$. If $\frac{x}{2}$ is an odd number, then $i^x = -1$.
4. A negative inside a radical cannot be affected by the sign outside the radical.